

## **RFID Technology : An Introduction**

**Sandeep**

Research Scholar, Deptt. of Library Science

BMU, Asthal Bohar.

**Seema**

Deptt. of Library Science ,BMU, Asthal Bohar

### **Abstract:**

Radio-frequency identification (RFID) is a technology that uses communication via electromagnetic waves to exchange data between a terminal and an electronic tag attached to an object for the purpose of identification and tracking. Some tags can be read from several meters away and beyond the line of sight of the reader. Their advantages are that they can be read wirelessly and without line of sight, contain more information than barcodes, and are more robust. The paper describes overview of RFID Technology and how useful in Library.

**Key Words:** RFID, Radio Frequency Identification, Tag, Library.

### **Introduction:**

RFID is an acronym for “Radio Frequency Identification” by which digital data encoded in RFID tags are captured by a reader with the help of Radio waves. The tags contain electronically-stored information. An RFID system consists of an RF device that communicates with a tag, which is embedded with a single-chip processor and an antenna. The RFID reader can be fixed or portable, much like the good - old barcode scanners. RFID tags are capable of storing and transmitting information. They vary in design and capability, depending on the manufacturer and their intended use. RFID tags are used in many industries, for example, an RFID tag attached to an automobile during production can be used to track its progress through the assembly line; RFID-tagged pharmaceuticals can be tracked through warehouses; and implanting RFID microchips in livestock and pets allows for positive identification of animals. RFID technology is

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very useful in library also. The first distinction between tags is whether they are passive or active. Passive tags collect energy from a nearby RFID reader's interrogating Radio waves. Active tags have a local power source (such as a battery) and may operate hundreds of meters from the RFID reader. Unlike a barcode, the tag need not be within the line of sight of the reader, so it may be embedded in the tracked object. RFID is one method for Automatic Identification and Data Capture.<sup>1</sup>

## Components of an RFID System:

A RFID system has basically four components:

- RFID tags that are electronically programmed with unique information
- Readers or sensors to interrogate the Tags
- Antenna Host computer with appropriate application software
- Antenna.

## RFID Tags:

They are tiny microchips with memory and an antenna coil, thinner than paper and some only 0.3mm across. RFID tags listen for a radio signal sent by a RFID reader. When a RFID tag receives a query, it responds by transmitting its unique ID code and other data back to the reader. RFID tags typically hold less than 2,000 KB of data, including a unique identifier/serial number.<sup>2</sup> RFID tags can be either passive, active or battery-assisted passive. An active tag has an on-board battery and periodically transmits its ID signal. A passive tag is cheaper and smaller because it has no battery; instead, the tag uses the radio energy transmitted by the reader. However, to operate a passive tag, it must be illuminated with a power level roughly a thousand times stronger than for signal transmission. That makes a difference in interference and in exposure to radiation. Tags may either be read-only, having a factory-assigned serial number that is used as a key into a database, or may be read/write, where object-specific data can be written into the tag by the system user. RFID tags contain at least three parts: an integrated circuit that stores and processes information and that modulates and demodulates radio-frequency (RF) signals; a means of collecting DC power from the incident reader signal; and an antenna for receiving and transmitting the signal<sup>3</sup>.

## RFID Readers:

RFID readers, also called interrogators query RFID tags in order to obtain identification, location, and other information about the device or product the tag is embedded in. The RF energy from the reader antenna is collected by the RFID tag antenna and used to power up the microchip. There are two types of RFID readers:

- **RFID read-only readers:** As the name suggests, these devices can only query or read information from a nearby RFID tag. These readers are found in fixed, stationery applications as well as portable, handheld varieties.
- **RFID read-write readers:** Also known as encoders, these devices read and also write (change) information in an RFID tag. Such RFID encoders can be used to program information into a "blank" RFID tag. A common application is to combine such a RFID reader with a barcode printer to print "smart labels". Smart labels contain a UPC bar code on the front with an RFID tag embedded on the back.

## RFID Antenna:

RFID antennas are used to collect information about any item. There are many types of RFID antenna like patch antennas, linear polarized antennas, stick antennas and adaptive antennas, gate antenna and Omni directional antennas.

## RFID Frequencies:

There are three main types of RFID systems:

Low frequency (LF), High frequency (HF) and Ultra-high frequency (UHF). Microwave RFID is also available. Frequencies vary by country and region.

- Low-frequency RFID systems range from 30 KHz to 500 KHz, though the typical frequency is 125 KHz. LF RFID has short transmission ranges, generally anywhere from a few inches to less than six feet.
- High-frequency RFID systems range from 3 MHz to 30 MHz, with the typical HF frequency being 13.56 MHz. The standard range is anywhere from a few inches to several feet.

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- UHF RFID systems range from 300 MHz to 960 MHz, with the typical frequency of 433 MHz and can generally be read from 25-plus feet away.

Microwave RFID systems run at 2.45 GHz and can be read from more than 30-plus feet away.

## **RFID System Working:**

A RFID system is made up of two parts: a tag or label and a reader. RFID tags or labels are embedded with a transmitter and a receiver. The RFID component on the tags have two parts: a microchip that stores and processes information, and an antenna to receive and transmit a signal. The tag contains the specific serial number for one specific object. To read the information encoded on a tag, a two-way radio transmitter-receiver called an interrogator or reader emits a signal to the tag using an antenna. The tag responds with the information written in its memory bank. The interrogator will then transmit the read results to an RFID computer program. Passive RFID tag will use the interrogator's radio wave energy to relay its stored information back to the interrogator. A battery powered RFID tag is embedded with a small battery that powers the relay of information. In a retail setting, RFID tags may be attached to articles of clothing. When an inventory associate uses a handheld RFID reader to scan a shelf of jeans, the associate is able to differentiate between two pairs of identical jeans based upon the information stored on the RFID tag. Each pair will have its own serial number. With one pass of the handheld RFID reader, the associate can not only find a specific pair, but they can tell how many of each pair are on the shelf and which pairs need to be replenished. The associate can learn all of this information without having to scan each individual item.

## **RFID System Applications:**

### **Toll Road :**

RFID applications make the toll collection/charging better with improved traffic flow, as cars/vehicles cannot pass through toll stations without stopping for payment. RFID is used to automatically identify the account holder and make faster transactions.

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## **Waste Management:**

RFID can be used for waste management. RFID tag is attached to each waste bin and every garbage truck has RFID reader attached to it. When waste bin is emptied into truck then reader read tag and transmits data to truck drivers cabin wirelessly. At end of route data is transmitted to central server. This data include waste bin number, collected at what time, who was waste collector.

## **Asset Tracking Objects:**

RFID can be used to prevent misplacement of items, or to locate items. An asset is tagged with RFID chip for its physical verification. A database is used to keep track of item movements.

## **Healthcare:**

RFID applications in healthcare could save important resources that can further contribute to better patient care. RFID applications could reduce the number of errors by tagging medical objects in the healthcare setting such as patients files and medical equipment tracking in a timely manner.

## **Animal Identification:**

RFID tag can be injected to remain under skin of animal. This process is less painful and there is no identification mark with the help of which tag can be removing or modify. RFID chip inside tag is Read-only, so data cannot be modified. This chip contain many information like date of birth, last vaccination done, any medical history and distinguishing features about the animal.<sup>4</sup>

## **RFID System in Library:**

RFID (Radio Frequency Identification) is the latest technology to be used in library theft detection systems. Unlike EM (Electro-Mechanical) and RF (Radio Frequency) systems, which have been used in Libraries for decades, RFID-based systems move beyond security to become tracking systems that combine security with more efficient tracking of materials throughout the library, including easier and faster charge and discharge, inventorying, and materials handling. RFID technology is applied to various activities in libraries like automated check in /check out, theft detection, stock verification etc. and comprises many components including RFID tags/labels, Library Staff Station, security gate, self service units, shelf management etc. and it

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can be extended to many more areas in future. Key words: RFID in library management, RFID issues, RFID privacy and policy, RFID in Indian libraries, best practice in RFID, deployment of RFID in library, guidelines for implementing RFID. Borrowing and returning of books can be fully automatized with the help of self checkin/out systems. This system involves installation of special software. A person using this system to borrow books, is presented with options on a computer screen. The person has to identify himself with a code, which is preferably a personal identification number, or any form of unique identity code. Books selected by the person are identified by the system's built-in RFID reader. And, the surveillance bit in the book's tag is deactivated by the system. When a book is returned, the check-in/out system activates the surveillance bit.<sup>5</sup>

## **Future Scope:**

RFID technology uses radio waves to automatically identify people or objects.. There are some problems needed to overcome before RFID technology becomes widespread in the world. One major problem is the high costs, the other is privacy issue. After avoiding problems, the RFID technology will be a big help to human. Price of RFID tags are expected to decrease. RFID tags will only become cheaper and more powerful with improving technology and design experience . There is improvement in tag life expectancy and durability in past few years. The RFID technology brings new opportunities as well as challenges to the AIDC infrastructure. Although RFID suffers from many limitation but still Demand for RFID systems is increasing day by day. Over times, the proportion of “scan-it-yourself” will increase. RFID technology does not replace barcode. This technology improves barcode by adding functions which existing barcode technology fail to achieve.

## **Conclusion:**

The paper gave an overview of current state and trends of RFID technology. RFID technology will open new doors to make organizations, companies more secure, reliable, and accurate. The first part of this paper has explained and described the RFID technology and its components. The last part explores RFID technology applications specially use in Library. The paper considers

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RFID technology as a means to provide new capabilities and efficient methods for several applications.

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